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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G02B 6/38 — A1

(11) International Publication Number: WO 96/30790

(43) International Publication Date: 3 October 1996 (03.10.96)

(21) International Application Number: PCT/US96/02893

(22) International Filing Date: 29 February 1996 (29.02.96)

(30) Priority Data:
08/410,029 24 March 1995 (24.03.95) US

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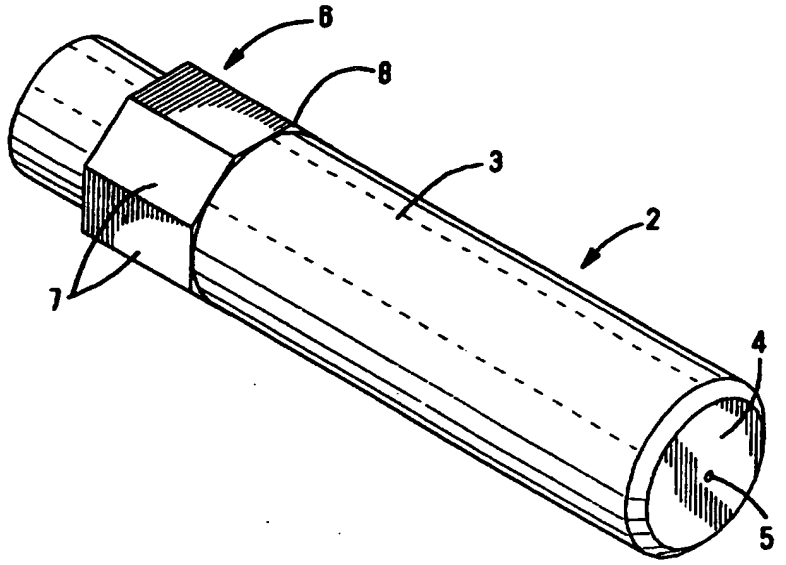
(81) Designated States: CA, CN, CZ, HU, JP, KR, PL, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: OVERMOLDED FIBER OPTIC CONNECTOR FERRULE CAPILLARY HAVING OCTAGONAL COLLAR



(57) Abstract

A fiber optic ferrule comprises a precision ferrule capillary (2) and a ferrule base (10). The ferrule capillary (2) has a polygonal collar (6). The ferrule base (10) is molded over the collar (6). The ferrule base (10) and the collar (6) cooperate to resist rotational and axial displacement of the ferrule capillary relative to the ferrule base (10).

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OVERMOLDED FIBER OPTIC CONNECTOR FERRULE CAPILLARY HAVING OCTAGONAL COLLAR

The present invention relates to fiber optic ferrules and more particularly relates to ferrule capillaries used in fiber optic ferrules.

Fiber optic connectors typically comprises a ferrule captivated by a coupling mechanism. The geometry of the coupling mechanism is generally independent of the ferrule. Ferrules may comprise a precision ferrule capillary providing a fiber retention and alignment function held by a ferrule base. Ferrule capillaries are known to be made of ceramic, metal and polymer. In the interest of minimizing fiber torsional stress, it is desirable that the ferrule capillary resist rotational displacement relative to the ferrule base at all times. During termination of a fiber optic connector, epoxy may be injected into a fiber passage internal to the ferrule. The process of injecting the epoxy subjects the ferrule capillary to an axial force, typically 5 lbs or less, relative to the ferrule base. It is desirable that the ferrule capillary resist axial movement in response to this "push out" force. As miniaturization is often an issue, it is desirable to have the axial and rotational antidisplacement features in a minimum amount of volumetric space.

A known ferrule capillary has a cylindrical volume with a notch at a nonmating end cut transverse to a longitudinal axis of the cylindrical volume. A ferrule base is overmolded at the notched end and surroundingly

engages the notch. The notch resists axial and rotational displacement of the ferrule capillary relative to the ferrule base. The notch further provides for miniaturization by obviating the need to increase the diameter of the ferrule capillary in order to include antidisplacement features. With respect to metal or ceramic ferrules overmolded by a base, the notch may be machined into the ferrule in a secondary operation prior to overmolding.

With respect to polymer ferrules, the notch feature is undesirable because a mold that creates the notch has a relatively large single discontinuity therein. Fiber optic connectors and in particular the ferrules used therein are precision parts. The molding process, therefore, should be carefully controlled in order to attain a manufacturing process having acceptable yields. Large discontinuities in a mold cavity tend to disturb the flow of the molten polymer as it enters the cavity during the molding process. This discontinuity makes it difficult to sufficiently control the molding process. It is desirable, therefore, for a polymer ferrule to be made in a mold wherein the number and size of discontinuities is minimized to streamline material flow.

An example of an overmolded ferrule is found in U.S. patent no. 5,375,183, the teachings of which are hereby incorporated by reference. A ferrule capillary comprises a cylindrical collar. The collar is overmolded by a base to form a fiber optic ferrule. The ferrule base should have a sufficient wall thickness to

retain the ferrule capillary and to resist axial and rotational displacement thereto. In a competing concern, it is desirable to minimize the maximum outer diameter of a ferrule due to space limitations internal to various fiber optic connectors. It is desirable, therefore, to have a ferrule having a relatively small maximum outer diameter with sufficient retention of the ferrule capillary within the base.

It is an object of the present invention that a polymer ferrule may be made in a mold that minimizes the flow disturbance during the molding process.

It is an object of the present invention that a ferrule capillary overmolded by a ferrule base resists rotation relative to the base.

It is an object of the present invention that a ferrule capillary overmolded by a ferrule base can withstand a push out force resisting axial movement of the capillary ferrule relative the base.

It is an object of the present invention to minimize the maximum outer diameter of a portion of the ferrule capillary overmolded by the ferrule base.

The objects have been accomplished by providing a fiber optic ferrule comprising a ferrule base and ferrule capillary where the ferrule base retainably engages an enlarged collar on the ferrule capillary, the enlarged collar having a flat side.

The preferred embodiment of the invention will now be described by way of reference to the drawings, where:

Figure 1 is a perspective view of a ferrule capillary according to the teachings of the present invention;

Figure 2 is a plan view of an end face of a ferrule capillary according to the teachings of the present invention;

Figure 3 is a cross sectional view of a ferrule capillary according to the teachings of the present invention sectioned along the length of the ferrule at the axis labeled 3--3 in Figure 2;

Figure 4 is a perspective view of a ferrule base molded over a ferrule capillary; and

Figure 5 is a cross sectional view of the ferrule shown in Figure 4.

With reference to Figures 4 and 5, a fiber optic ferrule 1 for use in a fiber optic connector (not shown) comprises a precision molded polymer ferrule capillary 2 overmolded by a ferrule base 10. In a preferred embodiment, the ferrule capillary 2 is made of polyethersulfone sold by Amoco under the trademark RADEL, and the ferrule base is made of thermoplastic polyester sold by General Electric Plastics under the trademark VALOX DR-48.

With reference to Figure 1, the ferrule capillary 2 comprises a substantially cylindrical alignment member 3 having a chamfered end face 4 at a mating end and a fiber passage 5 therethrough defining a longitudinal axis. The alignment member 3 is adjacent a polygonal collar 6. In a preferred embodiment, the collar is octagonal. Each of eight sides 7 of the collar 6

intersect with adjacent sides 7 to form eight interference shoulders 8. As best shown in Figure 2, the sides 7 are positioned tangentially to the outer diameter of the alignment member 3 in a preferred embodiment. The interference shoulders 8 extend radially past the outer diameter of the alignment member 3 defining a maximum ferrule capillary outer diameter. When the ferrule base 10 is overmolded onto the ferrule capillary, the molten polymer of the base envelopes the collar 6. The base polymer flows around the interference shoulders 8 conforming to the sides 7 of the ferrule capillary 2. The flat of the sides 7 and the conforming material of the base engage each other resisting rotational displacement of the ferrule capillary 2 relative to the ferrule base 10. The tangential positioning of the sides 7 of the collar 6 minimize the maximum outer diameter of the collar. With the maximum outer diameter of the collar 6 thus minimized, the overmolded ferrule base 10 is also minimized while having a wall thickness capable of providing sufficient axial interference to withstand push out forces of 45 lbs or more. It is preferred that the parting line of the mold for the precision ferrule capillary 2 be at the junction between the interference shoulders 8 and the alignment member 3.

Advantageously, an enlarged collar having a flat side resists rotation relative to the base retaining it and resists axial displacement when subjected to a push out force. Advantageously, an enlarged polygonal collar

according to the teachings of the present invention resists a push out force of 45 lbs or more.

Claims

1. A fiber optic ferrule comprising a ferrule capillary (2) and a ferrule base (10) retainably engaging said ferrule capillary (12), characterized in that said ferrule capillary (2) has an enlarged collar (6) having at least one flat side (7) thereon.

2. The fiber optic ferrule of claim 1, characterized in that said enlarged collar (16) is a polygonal.

3. The fiber optic ferrule as recited in any of the preceding claims wherein said ferrule capillary (2) further comprises a cylindrical alignment member (3) adjacent said collar (6) and wherein sides (7) of said collar (6) are positioned tangentially to an outer diameter of said cylindrical alignment (3) member.

4. The fiber optic ferrule as recited in any of the preceding claims wherein said collar (6) is octagonal.

5. The fiber optic ferrule as recited in any of the preceding claims wherein said ferrule capillary (2) is overmolded by said base (10).

6. The fiber optic ferrule as recited in any of the preceding claims wherein said ferrule capillary (2) further comprises a cylindrical alignment member (3) adjacent said collar (6) and wherein sides (7) of said collar (6) are positioned tangentially to an outer diameter of said cylindrical alignment member (3).

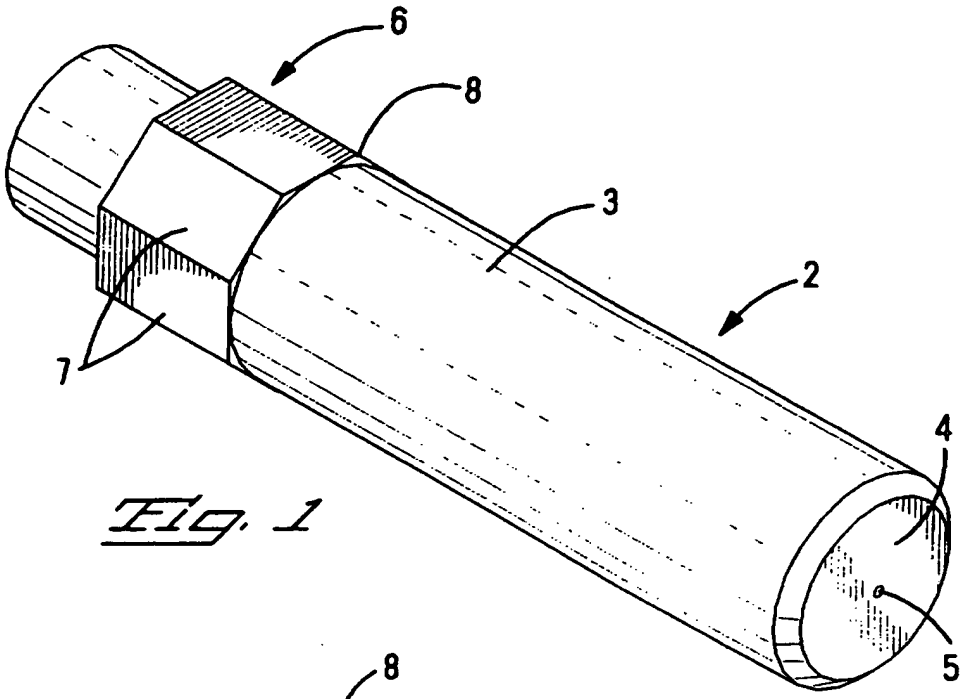

Fig. 1

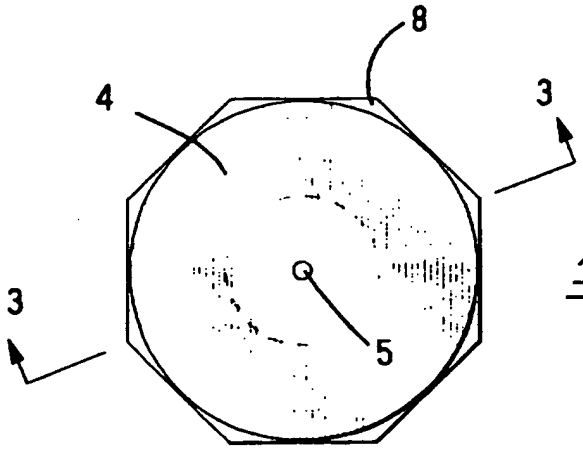

Fig. 2

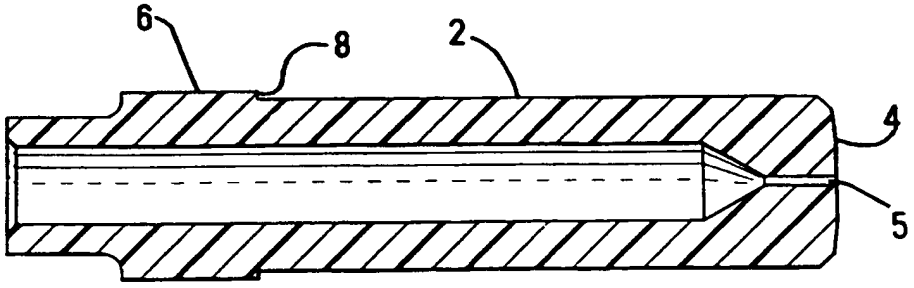

Fig. 3

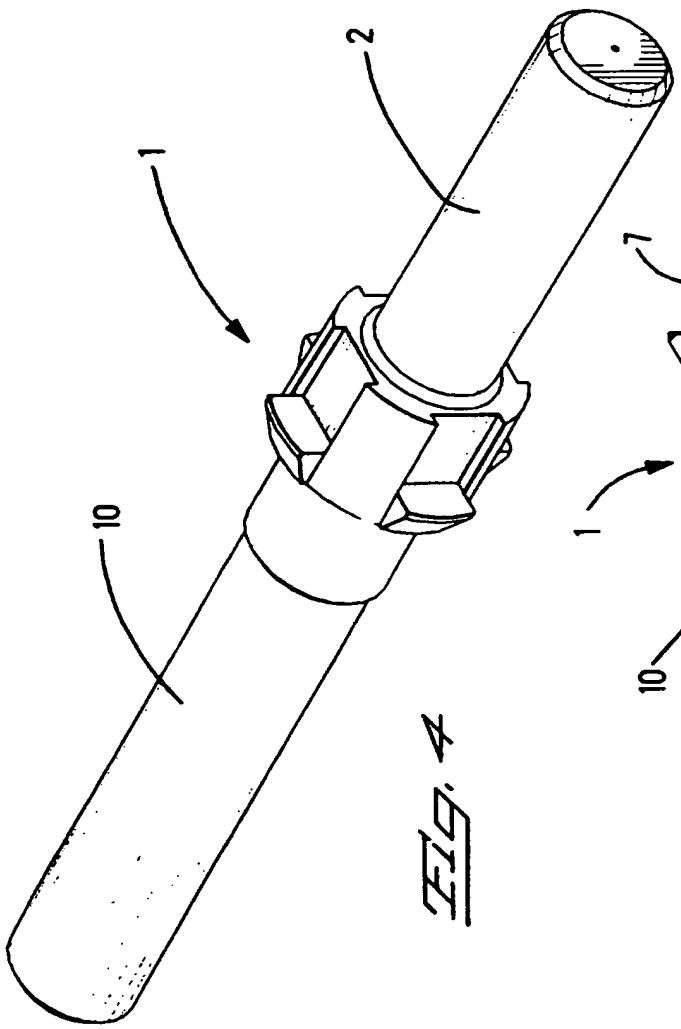

Fig. 4

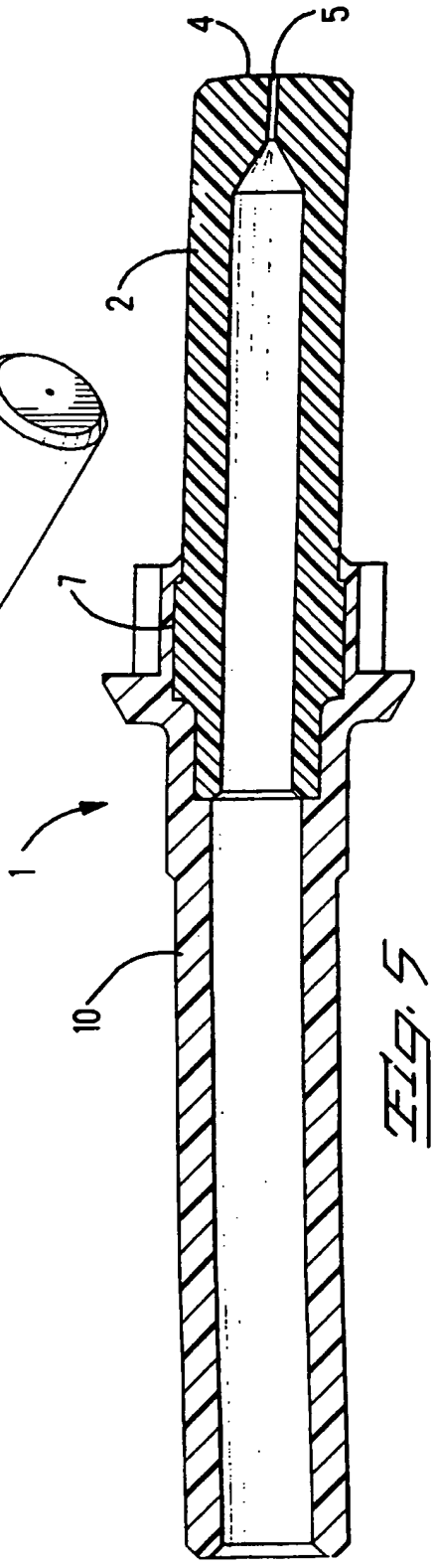

Fig. 5

INTERNATIONAL SEARCH REPORT

Int. ..onal Application No
PCT/US 96/02893

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G02B6/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,5 375 183 (EDWARDS) 20 December 1994 cited in the application see column 3, line 30 - column 4, line 24 see figure 3	1
A	US,A,5 394 497 (ERDMAN) 28 February 1995 see column 3, line 17 - line 45 see figure 1	1
A	WO,A,87 01464 (AMP) 12 March 1987 see page 8, line 22 - page 9, line 11 see figures 1-3	1
A	PATENT ABSTRACTS OF JAPAN vol. 12, no. 443 (P-790), 22 November 1988 & JP,A,63 172106 (SUMITOMO) see abstract	1

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Date of the actual completion of the international search	Date of mailing of the international search report
5 July 1996	17.07.96
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A	GB,A,2 239 104 (KEI) 19 June 1991 see page 13, line 3 - line 23 see figure 5 -----	1

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Information on patent family members

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PCT/US 96/02893

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A-5375183	20-12-94	EP-A-	0626601	30-11-94
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US-A-5394497	28-02-95	BR-A-	9500678	24-10-95
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